UNITED NATIONS

Framework Convention on Climate Change

Distr.
GENERAL

FCCC/TP/1997/5
20 November 1997

ENGLISH ONLY

METHODOLOGICAL ISSUES

SYNTHESIS OF INFORMATION FROM NATIONAL COMMUNICATIONS OF ANNEX I PARTIES ON SOURCES AND SINKS IN THE LAND-USE CHANGE AND FORESTRY SECTOR

Technical Paper

GE.97-64986

CONTENTS

		Paragraph	Page
I.	INTRODUCTION	1 - 2	3
II.	METHODOLOGICAL BACKGROUND	3 - 7	3
III.	REPORTING BY PARTIES	8 - 25	4
	A. Background	8 - 9	4
	B. First national communications and in-depth reviews	10 - 14	5
	C. Second national communications	15 - 25	7
IV.	SUMMARY OF INFORMATION FROM NATIONAL COMMUNICATIONS AND IN-DEPTH REVIEWS	26 - 28	10

Annex

Sub-categories of the land-use change and forestry category of the IPCC Guidelines 18

I. INTRODUCTION

1. Article 4.1 of the United Nations Framework Convention on Climate Change (UNFCCC) states that Parties shall make available to the Conference of the Parties (COP) national greenhouse gas (GHG) inventories using comparable methodologies. Parties adopted the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories as the standard methodology for reporting their national GHG inventories (Decisions 3/CP.1 and 9/CP.2). In applying the IPCC Guidelines, some Parties have identified methodological issues and problems with respect to estimating and reporting emissions and removals for the land-use change and forestry category.[1]

2. This paper provides a brief overview of the issues related to estimating and reporting land-use change and forestry emissions/removals raised by Parties in the first and second national communications and in-depth reviews of first national communications. The issues raised in the first national communications and in-depth reviews are covered to a limited extent, while more detailed information has been provided on the second national communications.

II. METHODOLOGICAL BACKGROUND

3. In their national communications, most Parties reported emissions/removals from land-use change and forestry in accordance with the IPCC Guidelines. The methods for estimating emissions/removals allow for two general approaches, both of which, in principle, give similar results:

(a) Measuring the changes in stock directly, by quantifying growth, harvest and other losses. This approach provides estimates of both gross emissions and removals by source and sink; and

(b) Measuring total stock, by making a forest inventory at two points in time and calculating the difference. This approach provides only the net change.

4. The IPCC Guidelines have been designed to provide a calculation and reporting framework which can accomodate users with different levels of available data, yet allow them all to present the results on a comparable basis. The national emission/removal estimates presented using this framework provide for comparability amongst Parties.

5. The IPCC Guidelines can be implemented at several different levels of complexity. They provide a simple, first order approach, which can be based on aggregate default data and assumptions. However, many of the default data are highly uncertain. A more accurate estimate can be achieved simply by substituting country-specific values for the default values provided for by the IPCC methodology, which the IPCC Guidelines encourage. The IPCC methodology also

---

[1] The annex provides a summary of the sub-categories which constitute the land-use change and forestry category.

allows for the use of detailed forest inventory data. National experts who have detailed inventory data can reformat and analyse these data to derive equivalent average responses which can be aggregated up to categories matching the simple approach for comparability and transparency purposes.

6. The land-use change and forestry category in the IPCC Guidelines has been improved upon in the latest edition of the Guidelines, the Revised 1996 IPCC Guidelines, and further improvements may be developed. However, in order to improve upon the estimation methods for this sector, an understanding of the reporting problems and interpretation and application of the Guidelines by Parties with regard to the sub-categories in land-use change and forestry would be useful.

7. The methodologies for estimating emissions/removals from the land-use change and forestry category require high quality statistical data and emission factors. There are uncertainties associated with both of these elements. In this paper, the term methodological issues encompasses aspects of statistical data and emission factors as well as algorithms to estimate emissions.

III. REPORTING BY PARTIES

A. Background

8. Eighty-four percent of the Annex I Parties have reported emissions/removals for the land-use change and forestry category, either in their first or second national communications. For all the Parties, except Australia and the United Kingdom of Great Britain and Northern Ireland, this sector constituted a net sink rather than a source. For the year 1990, when these estimates are included in total CO_2 emissions, the percentage reductions in emissions ranged from 1 to 81 percent, and for Australia and the United Kingdom, the emissions added 24 and 3 percent, respectively. Comparison and aggregation of emissions and removals was made difficult by the different ways of reporting them, but the aggregate removals from this category represent 6.7 and 8 percent of total GHG emissions in CO_2 equivalent and total CO_2 emissions of the reporting Annex I Parties, respectively. Table 1 presents inventory and projection data for the land-use change and forestry category for the year 2000 as reported by Parties. Additionally, document FCCC/SBI/1997/19/Add.1 (table C.2) provides longer-term projections for 12 of the reporting Parties and inventory data.

9. Table 2 shows the relative share of the emissions/removals in 1990 for each land-use change and forestry sub-category. *Changes in forest and other woody biomass stocks*[2] represent 88 percent of the reported carbon fluxes of all reporting Parties jointly, and more than 90 percent for all of them except Australia, Estonia, France and United Kingdom. The aggregated removals of this sub-category represents a reduction of 9 percent of the total CO_2 emissions of the reporting Annex I Parties for the year 1990.

B. First national communications and in-depth reviews[3]

10. In the first national communications and subsequent in-depth reviews of the first national communications carried out by the UNFCCC secretariat, several concerns and problems with regard to emission/removal estimates for the land-use change and forestry category were identified. Both the reporting Parties and the review teams noted problems with the reliability and comparability of estimates due to the degree of scientific uncertainty and difficulties in data generation, and in particular the variation in data availability amongst Parties. Furthermore, several Parties emphasized the large uncertainties and difficulties in differentiating natural and anthropogenic sources and sinks. Parties also expressed reservations in relation to the reliability of the IPCC default methodology and its applicability in estimating the carbon uptake and release and comparability of estimates amongst Parties in view of the varying conditions of Parties.

11. Several Parties, in the first national communications, and/or during the in-depth reviews, expressed the desire for further scientific work in this area so as to overcome the difficulties they were encountering. Some of these Parties indicated that the high level of uncertainty was an obstacle to presenting reliable estimates in their first communications, although a number of Parties provided first-time or updated estimates for land-use change and forestry during the in-depth reviews.

12. Although the degree of detail in reporting varied amongst Parties and to some degree the assumptions and/or methodologies differed, certain aspects were prevalent across the Parties. The principal methodological issues and problems with respect to reporting of emissions and removals in the land-use change and forestry category in the first national communications were:

(a) Lack of a common reporting framework for emissions from the sub-categories of the land-use change and forestry category;

---

[2] Italics are used throughout the report to denote the IPCC source/sink sub-categories within the land-use changeand forestry category as defined in the IPCC Guidelines for National Greenhouse Gas Inventories and indicated in the annex.

[3] Includes the following Parties: Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Romania, Russian Federation, Slovakia, Spain, Sweden, Switzerland, United Kingdom and United States of America.

(b) Different assumptions used to define anthropogenic activities, including the differentiation between managed and natural forests;

(c) Different assumptions about the utilization and decay of wood products and consequently, the CO_2 sequestration in them;

(d) Different assumptions regarding emissions from biomass combustion in the estimates of CO_2 net emissions from *changes in forest and other woody biomass stocks* sub-category; and

(e) Land-cover classifications defined by the IPCC Guidelines were found to be unsuitable for some Parties.

13. The vast majority of Parties reporting emissions/removals for the land-use change and forestry category provided estimates for the sub-category *changes in forest and other woody biomass stocks* (*managed forests* in Draft IPCC Guidelines). Reporting of estimates from the other land-use change and forestry sub-categories was limited, as indicated by some Parties, due to the methodological and reporting problems indicated above. Emissions from the *forest clearing and on-site burning* sub-category (Draft IPCC Guidelines) were reported by Australia, France and New Zealand, while Estonia and France reported emissions from *forest and grassland conversion*. Australia reported a removal from *forest and grassland conversion* more than twice the size of the removal reported from *managed forests*. Estonia and France were the only Parties reporting removals from the *abandonment of managed lands* sub-category. The United Kingdom included emissions from peat extraction, drainage of wetlands and deep peat in their land-use change and forestry estimate. Finland and the Russian Federation provided estimates of removals from peatlands in this sector, although the former did not include it in its inventory.

14. Since the UNFCCC secretariat's assessment of inventories in the first and second compilation and synthesis of first national communications of Annex I Parties and the assessments of the in-depth review teams, the IPCC Guidelines have been revised. In particular, the Revised 1996 Guidelines have addressed problems arising from land-cover classification, with a new classification system addressing the tropical, temperate and boreal regions. Concerns about the different assumptions with respect to utilization and decay of wood products are also under review in the IPCC Work Programme and will be given further consideration in future meetings of IPCC expert groups. As only some of the methodological issues and problems identified in the first national communications have been addressed or are currently under consideration and review, several of these issues have arisen in the second national communications as well.

C. Second national communications[4]

1. Reporting framework

15. Of the 18 second national communications submitted as of 1 September 1997, all but three Parties, Canada, Iceland and Monaco, provided CO_2 estimates from land-use change and forestry. Canada stated that it was not possible to provide estimates in the manner provided for in the IPCC Guidelines. However, its national communication did include a detailed description of the model used for estimation of the carbon fluxes in its forests. Although Iceland did not provide any official estimates, a description of the ongoing activities and preliminary estimates from the category were included in the national communication. Monaco reported estimates from this category as negligible. All the Parties reporting estimates for land-use change and forestry, except the United Kingdom, considered that the category constitutes a sink rather than a source.

16. The methods used to estimate emissions and removals for the land-use change and forestry category and the reporting of these estimates varied widely amongst Parties in the second national communications. Many problems with estimating and reporting were noted in the first national communications. These are still prevalent and affect the comparability of estimates among Parties.

17. As in the first national communications, the reporting framework used by Parties was not completely uniform. Eleven (Belgium, Czech Republic, France, Germany, Netherlands, New Zealand, Norway, Slovakia, Sweden, Switzerland and United Kingdom) of the 15 Parties which reported estimates for land-use change and forestry presented their estimates using the IPCC standard data tables. Of these Parties, Germany and New Zealand used their own methods or models rather than the IPCC methodology to calculate emission/removal estimates, while for several of the other Parties it is not clear whether the IPCC methodology was used. Austria, Finland, Ireland and the United States did not present IPCC standard data tables, although Finland used the IPCC methodology to calculate the sink capacity of its forests. The United States used its own methodology, which does not require calculation of growth increment and harvest as reported in the IPCC format, but it is unclear from the national communication which methods were used by Austria and Ireland.

18. For six (Austria, Germany, Finland, New Zealand, United Kingdom, and United States) of the 15 Parties which reported land-use change and forestry, the estimates provided in the second national communication differed from those in their first national communication, which was the case for many Parties for other gases and sectors as well. For example, for the 17 Annex

---

[4] Includes the following Parties: Austria, Belgium, Canada, Czech Republic, Finland, France, Germany, Iceland, Ireland, Monaco, Netherlands, New Zealand, Norway, Slovakia, Sweden, Switzerland, United Kingdom and United States.

I Parties which submitted their second national communications, estimates differed from their first national communications for CO_2 (excluding land-use change and forestry), for six Parties, and for CH_4 and N_2O for 13 and 14 Parties, respectively. Austria and Germany did not provide any explanation as to the revision of their estimates. In the case of Finland, the estimate differs due to the inclusion of a new range of estimates from peatlands in its estimate of land-use change and forestry. The estimates differed for New Zealand and the United States on account of an increase in their forests sink capacity as a consequence of improved data, and in the case of New Zealand also due to refining of the methodology used. The United Kingdom reported an increased sink capacity due to improved statistics and new data. It also included a new estimate of emissions for *forest and grassland conversion*. This new estimate is due to the conversion of uncultivated land into agriculture and urban use. Recent modelling has indicated that this conversion does not have a zero net flux as previously assumed. As a consequence of these changes and new estimates, the land-use change and forestry sector in the United Kingdom is a net source rather than a sink as in its first national communication.

2. Completeness of reporting and uncertainty

19. Despite the differences in the assumptions used, all Parties reporting estimates from the land-use change and forestry category provided estimates for the sub-category *changes in forests and other woody biomass stocks*. The degree of reporting for this sub-category was 88 percent, similar to other GHG emission sub-categories, such as CH_4 from fugitive fuel emissions and N_2O from fuel combustion. Only 35 percent of the reporting Parties estimated emissions/removals in one or more of the other sub-categories. Four Parties (France, New Zealand, Slovakia and United Kingdom) reported estimates for *forest and grassland conversion* and only three Parties (Austria, France and United Kingdom) reported estimates for *abandonment of managed lands*. Although some Parties indicated that these estimates were negligible, the reason for their exclusion was not clear for many of the Parties. Austria, Czech Republic, Finland, France, Slovakia and United Kingdom reported emissions in the *other* sub-category, which may include activities such as shifting cultivation, flooding and wetland drainage or surface waters for which the IPCC have not yet developed default methodologies. However, in the case of the Czech Republic and Slovakia, this was due to on-site burning which in the Revised 1996 IPCC Guidelines is included under *forest and grassland conversion*. Finland and the United Kingdom provided estimates of the CO_2 removal of their peatlands, but did not provide estimates of their CH_4 emissions. The carbon flux model used by Canada included prescribed burning.

20. Table 3 contains an overview of the uncertainty of the estimates in the second national communications reported by Parties. The reported uncertainties are related to specific estimates for an individual year. When the emission estimates are compared over time, the resulting relative uncertainty is generally lower than the uncertainty of estimates for individual years.

21. Although the criteria for classification of the different reported values of uncertainty among Parties varies, the level of uncertainty for the sub-category *changes in forest and other woody biomass stocks* was generally equivalent to that of most of the reported CH_4 sources and lower than that for most of the reported N_2O sources. It was also lower than that of the other land-use change and forestry sub-categories.

3. Other issues

22. Fires or burning of biomass were considered explicitly by Canada, Czech Republic, France, New Zealand and Slovakia. These five Parties and Austria also reported emissions of non-CO_2 trace gases for land-use change and forestry. Only three Parties (France, Sweden and Switzerland) included fuelwood consumption in the sub-category *changes in forest and other woody biomass stocks*, but other Parties (Canada, Finland, Netherlands, Switzerland, United Kingdom and United States) reported biomass burning in the fuel consumption sub-categories. It is not possible to say whether the remaining Parties excluded estimates of fuelwood or biomass burning as the information available was not adequate and it is possible that national harvest statistics have taken them into account.

23. Only the United Kingdom considered carbon soil estimates in the sub-category *changes in forest and other woody biomass stocks*, but some Parties (Canada, Finland, France, Iceland, Sweden and United States) provided information on estimations of the carbon removal from forest soil. Several Parties mentioned the uncertainty in soil carbon estimates and in the impact of forest management activities on soil and forest/vegetative cover.

24. The IPCC Guidelines state that natural, undisturbed forests, where still in equilibrium, should not be considered either as anthropogenic source or sink, and therefore can be excluded from national inventory calculations. However, the IPCC Guidelines do not provide a clear definition of which forest activities could be considered anthropogenic or not, although work is on-going in this regard. Compared to the first national communications, there were no significant changes in diverging assumptions regarding differentiating natural and anthropogenic activities and the manner of reporting emissions from these activities. With a few exceptions, Parties did not specify whether all forests were considered as managed or not. Germany stated that almost all its forests are managed. Finland did not classify its forest as managed or not, but differentiated its peatlands between natural and managed. The United States only considered managed timberland, not taking into account unreserved and reserved unproductive forest land. The Canadian carbon flux model included all forests. New Zealand accounted for fires and logging in its indigenous forests, but did not include any estimate of their sequestration capacity, although it noted that research was on-going.

25. There are other differences in the assumptions used by Parties to estimate emissions/removals from the *changes in forest and other woody biomass stocks* sub-category. For example, the methodology applied by the United States considered carbon contained in wood products and landfills. The Canadian model also considered the total carbon accumulated from harvesting. Canada and Finland expressed the view that this carbon pool was small, but important in terms of the annual flux, or in movement of carbon pools.

IV. SUMMARY OF INFORMATION FROM NATIONAL COMMUNICATIONS AND IN-DEPTH REVIEWS

26. The land-use change and forestry category constituted a net sink rather than a net source for all but two Parties. The aggregated net emissions/removals of this category represent 6.7 and 8 percent respectively of total GHG emissions in CO_2 equivalent and total CO_2 emissions of the reporting Annex I Parties. The percentage of net reduction or increase of national CO_2 emissions after taking this category into account varied widely amongst Parties.

27. The coverage of data and the reported confidence levels in the estimates for the *changes in forest and other woody biomass stocks* is better than for other land-use change and forestry sub-categories. The reported uncertainties from this sub-category are equivalent to that of most of the reported sources of CH_4 and lower than that for most of the reported N_2O sources. The completeness of reporting of this sub-category is similar to that of many sources of CH_4 and N_2O. Eighty-eight percent of the reported carbon fluxes in the land-use change and forestry category are from the *changes in forest and other woody biomass stocks* sub-category. The aggregated removals of this sub-category represent a reduction of 9 percent of the total CO_2 emissions of the reporting Annex I Parties for the year 1990.

28. From a preliminary assessment of second national communications, it is clear that further methodological work is necessary in order to ensure that the estimation and reporting of GHG inventory data for land-use change and forestry are consistent, transparent and comparable. Some of the issues and problems with respect to reporting of emissions/removals in the land-use change and forestry category that were noted in the first national communications and in-depth reviews have been addressed or are under review, however, others still exist. Among the problems still prevailing are:

(a) Lack of uniformity in reporting and varying assumptions amongst Parties. Some of these problems are a logical consequence of different national circumstances and data, and some are a consequence of different methodological approaches. A number of Parties have been able to provide data in the IPCC reporting format despite using vastly different models and forest data sets. This suggests that uniform reporting is possible, although some countries may need guidance or assistance to overcome unique problems; and

(b) Different definitions of anthropogenic activities, including the differentiation between managed and natural forests. This issue requires special methodological guidance.

[This page has intentionally been left blank]

Table 1: Anthropogenic CO_2 emissions and removals from land-use change and forestry and impact on total CO_2 emissions, 1990 and 1995; projections for 2000 (Gigagrams and percentage)

Country	Land-use change and forestry, net emissions or removals		Percentage reduction or increase (-/+) of national CO_2 emissions taking into account land-use change and forestry		Projections	
	1990	1995	1990	1995	2000	percentage change from baseline[b]
	(Gg)	(Gg)	%	%	(Gg)	(%)
Australia[c]	86 500	51867	25	17	121 992	-6.8
Austria	-13 300	-13 580	-21	-22		
Belgium[d]	-2 057	-2 057	-2	-2	-2 057	0
Bulgaria (1988)	-4 657	-6 941	-5	-12	-5 801	0
Canada[e]						
Czech Republic	-2 281	-5 454	-1	-4	-5 000	-250
Denmark	-2 600		-5		-2 600	0
Estonia[f]	-8 555		-23			
Finland[g]	(-30 000)- (-19 000)	(-14 000) - (-7 000)	(-56) - (-35)	(-22) - (-12)	(-12 000) - (-17 000)	(62)-(46)
France	-33 218	-46 801	-9	-12	-39 000	-21.8
Germany	-30 000	-30 000	-3	-3		
Greece						
Hungary (1985-87)	-3 097	-4 820	-4	-8		
Iceland[h]						
Ireland	-5 160	-6 230	-17	-18	-7 580	-47
Italy	-36 730		-9		-46 730	-27.2
Japan	-83 341	-94 619	-7	-8	-92 000	-2.2
Latvia	-14 300	-15 831	-62	-141	-8 940	37.5
Luxembourg						
Netherlands	-1 500	-1 700	-1	-1	-1 700	-13
New Zealand	-20 569	-13 487	-81	-49	-18 944	-8
Norway	-10 200	-13 637	-29	-36	-11 000	17
Poland (1988)	-1 408	-43 861	0	-12		
Portugal						
Romania (1989)	-2 925		-1			
Russian Federation	-392 690	-568 850	-17	-35		
Slovakia	-4 257	-5 116	-7	-11	-5 227	-24
Spain	-23 166		-10		-25 700	-10.9
Sweden[i]	-34 368	-30 000	-62	-54	-29 000	15
Switzerland	-4 360	-5 100	-10	-12	-5 100	-17
United Kingdom[j]	18 776	9 945	3	2	11 100	-46
United States	-458 000	-428 000	-9	-8	-411 040	10.4
Total	-1 111 963		-8			

Notes to Table 1:

[a] Figures from table 5 of the document FCCC SBI 1997 INF 4 have been used in this table with the exception of an updated figure from the Estonian in-depth-review and the new inventory data submitted recently by Australia to the secretariat.

[b] Negative values in Gg denote removal of CO_2. Positive values denote a net source of emissions. Negative value in percentage denotes a larger removal in 2000 than the base year, or a decrease in net emissions. The base year for inventories may differ from the base year for projections, for example, due to revisions of inventories, rounding, calibration of models, or the projection of only a subset of the sources.

[c] The projection data presented is taken from the first national communication and could be not consistent with the new inventory data submitted by Party. The updated net emission for the year 1990 is 86 500 Gg instead of the value of 130 843 Gg reported in the first national communication.

[d] As estimates for 1995 were not available, estimates for the last reported year, 1994, are given in this table.

[e] The Party was not able to provide estimates in the manner provided for in the IPCC Guidelines, however, it did include in its national communication a detailed description of the model used for estimation of the carbon fluxes in its forests.

[f] The 1990 data included here was updated during the in-depth-review of the national inventory. The 1994 inventory data year is not included here for consistency, because the data available in the secretariat is previous to the IDR.

[g] A range of estimates of emissions from cultivated peatlands and non-viable drainage areas were included, thus a range for the total estimates from land-use change and forestry are given in this table.

[h] The Party did not provide any official estimates, however did include in its national communication a description of the ongoing activities and preliminary estimates from the sector.

[i] As estimates for 1995 were not available, estimates for the last reported year, 1992, are given in this table.

[j] The estimates include emissions and removals from wetland drainage and peat extraction.

Table 2: **Reported anthropogenic CO_2 emissions and removals[a] from land-use change and forestry by sub-categories for 1990 (Gigagrams and percentage of total flux from land-use change and forestry[b])**

Country	Total net emissions or removals from land-use change and forestry (Gg)	Changes in forest and other woody biomass stocks		Forest and grassland conversion		Abandonment of managed land		Other	
		(Gg)	(%)	(Gg)	(%)	(Gg)	(%)	(Gg)	(%)
	A+B+C+D	A	[b]	B	[b]	C	[b]	D	[b]
Australia	86 500	-23 082	15.5	117 574	79.1			-7993[c]	5.4
Austria	-13 300	-13 110	98.6	0	0.0	-190	1.4		
Belgium[d]	-2 057	-2 057	100						
Bulgaria (1988)	-4 657	-4 657	100						
Canada[d]									
Czech Republic	-2 281	-2 281	100						
Denmark	-2 600	-2 600	100						
Estonia[e]	-8 555	-5 224	53.8	577	5.9	-3 909	40.3		
Finland	(-30 000)-(-19 000)	-31 000	(72.1)-(96.8)					(+1 000)-(+12 000)[f]	(3.1)-(27.9)
France	-33 218	-37 899	62.5	13 729	22.6	-9 048	14.9		
Germany	-30 000	-30 000	100						
Greece									
Hungary (1985-87)	-3 097	-3 097	100						
Iceland[d]									
Ireland	-5 160	-5 160	100						
Italy	-36 730	-36 730	100						
Japan	-83 341	-84 391	98.8	579	0.7			471[c]	0.6
Latvia	-14 300	-14 300	100						
Luxembourg									
Netherlands	-1 500	-1 500	100						
New Zealand	-20 569	-22 056	93.7	1 487	6.3				
Norway	-10 200	-10 200	100						
Poland (1988)	-1 408	-1 408	100						
Portugal									
Romania (1989)	-2925	-2925	100						
Russian Federation	-392690	-392690	100						
Slovakia	-4 257	-5 766	79.3	462	6.4			1 047[g]	14.4
Spain	-23 166	-23 166	100						
Sweden	-34 368	-34 368	100						
Switzerland	-4 360	-4 360	100						
United Kingdom	18 776	-9 685	23.7	26 563	64.9	-1 402	3.4	3 300[h]	8.1
United States	-458 000	-458 000	100						
Total[i]	-1 111 963	-1 261 712	87.6	160 971	11.2	-14 549	1.0	3 325	0.2

Notes to Table 2:

[a] Negative values in Gg denote removal of CO_2. Positive values denote a net source of emissions.

[b] The given percentages represent the proportion of emissions and removals of this category in relation to the sum over the absolute values of the net emissions in each category. For example, the percentage figure for *changes in forest and other woody biomass stocks* for Australia is 23 082 / (23 082 + 11 7574 + 7 993)*100 = 15.5.

[c] The Party included emissions and or removals from soils.

[d] The Party did not provide any official estimates, however, it did include in its national communication a description of the ongoing activities and estimates from the sector.

[e] The aggregated figure was obtained during the in-depth review.

[f] A range of estimates of emissions from cultivated peatlands and non-viable drainage areas were included, thus a range for the total estimates from land-use change and forestry are given in this table.

[g] The Party included emissions and removals from on-site burning of cleared forests.

[h] The Party included emissions and removals from wetland drainage and peat extraction.

[i] The total values were calculated using, in the case of Finland, the average values for the reported range.

Table 3: **Confidence levels[a] (qualitative[b] or quantitative (± percent)) of GHG emission estimates in the main source and sink categories reported in the 2nd National Communications**

Gas and Source/sink	BEL	CAN	CHE	CZE	FIN	GBR	ICE	NLD	NZL	SLO	SWE	USA
CO_2[c]	2	4[d]	H	8-10	H-M	H 5	H	H 2	5	H 10	H-M	H
Fuel combustion		3	H	H-M	H	H	H	H		H	H	H 1-2
Industrial processes		15	H		H	H	H	H		M	M	H
Changes in forest[e]	25		H			L 15		M	25	H 35		L
Other LUCh&F[f]						L 50			35	M		L
CH_4	30	30[g]	M	40	M L	M 20	M L	M 25	50	M L 30-50	M H	M L
Fuel combustion		40	M	20-30	L	L	M	M		L	M	M
Fugitive: oil & gas		30	M	20-30	M	M		M		M		L
Fugitive: coal mining		40		40-50		M				M		H 20[g]
Enteric fermentation		30-50	M	20-30	M	M	M	M		M	H	M 20
Waste animal		50	M	20 -30	M	M	L	L		M	M	M
Waste		30	M		M	L	L	M		M-L	M	M-L 20
N_2O	50	40[d]	M L	80-100	M	H/L	L	L 50	50	L >100	L	H/L[h]
Fuel combustion		50-60	M		M	L	L	L		L	L	L
Inorganic chemicals		30	M		M	H		L				H[h]
Organic chemicals		15				H				L	L	H[h]
Agricultural soils		60-100	L		M	L	L	L		L	L	L

Notes to Table 3:

[a] The secretariat uses the term "confidence levels" to compile consistently data presented by Parties using different terms: uncertainties, emissions range, accuracy, etc.

[b] High (H); Medium (M); Low (L). When different benchmarks were reported for the same GHG, the predominant figure is pointed out using a "bold" letter.

[c] Reported uncertainties in this row correspond to CO_2 emissions excluding *land-use change and forestry*.

[d] The emissions range presented by Canada has a different confidence level: 95, 90 and 85 percent for CO_2, CH_4 and N_2O, respectively.

[e] *Change in forest and other woody biomass stock* subcategory.

[f] Other subcategories of *land-use change and forestry* category.

[g] The uncertainty of 20 percent refers only to underground mining ventilation systems; the uncertainty for surface mining is about 100-300 percent.

[h] Party assigned "high" confidence level to the uncertainty related to N_2O industrial process emissions in general.

Annex

SUB-CATEGORIES OF THE LAND-USE CHANGE AND FORESTRY CATEGORY OF THE IPCC GUIDELINES[1]

1. The category land-use change and forestry of the 1995 IPCC Guidelines for National Greenhouse Gas Inventories, used by Parties to report their second national communications has three main sub-categories:

(a) *Changes in forest and other woody biomass stocks* refer mostly to changes in forests, which account globally for the largest component of total changes in biomass stocks. The basic calculations focus primarily on a few types of human interactions with forests which are believed to result in the most significant fluxes of carbon. However, national experts are encouraged to estimate emissions for any activity related to existing forests which is considered to result in significant carbon emissions or removals, and for which necessary data is available. Some activities in this sub-category which can potentially produce significant carbon fluxes are:

(i) Management of commercial forests, including logging, restocking, selective thinning, etc;

(ii) Establishment and management of commercial plantations, forest stands that have been established artificially to produce a forest product "crop". They are either on lands that previously have not supported forests for more than 50 years (afforestation), or on lands that have supported forests for the last 50 years and where the original crop has been replaced with a different one (reforestation);

(iii) Other afforestation and reforestation programmes; and

(iv) Informal fuelwood gathering.

(b) *Forest and grassland conversion* which includes conversion of existing forests and natural grasslands to other land uses, such as agriculture. The calculation of carbon fluxes due to forest and grassland conversion is in many ways the most complex of the emissions inventories components, because responses of biological systems vary over different time-scales. The estimation of these emissions requires at least statistical data of 10 years or more.

(c) *Abandonment of managed lands* which considers the carbon re-accumulation in biomass and soils as a consequence of the abandonment of croplands or pastures. The response of these covered systems to abandonment depends upon a complex suite of issues including soil type, length of time in pasture or cultivation, and the type of the original ecosystems. A 20-year

---

[1] This annex is a summary of the sub-categories of the land-use change and forestry category and includes extracts from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

historical time horizon is suggested to capture the more rapid growth expected, but a second time period, from 20 to 100 years, may be considered if data are available.

2. As in the previous IPCC Guidelines, the Revised 1996 IPCC Guidelines include these sub-categories in the land-use change and forestry category, as well as a sub-category for *other*. It also has one new sub-category: *Changes in mineral soil carbon stocks*, which allows for the inclusion of three potential sources of CO_2 emissions from agricultural soils (net changes in organic carbon stocks of mineral soil associated with changes in land use and management, emissions from cultivated organic soils and emissions from liming of agricultural soils).

3. The Draft (1994) IPCC Guidelines used by some Parties in their first communications had a different classification system for the land-use change and forestry sub-categories: *Forest clearing; on-site burning of cleared forests; grassland conversion* (these three sub-categories are equivalent to the current *forest and grassland conversion sub-category); abandonment of managed land;* and *managed forests* (equivalent to the current *changes in forests and other woody biomass stocks* sub-category).